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Model-Based Systems Engineering for Analyzing an Organization

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MS Information Security, Spring 2019

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Goal: Use Model-Based Systems Engineering to analyze Sandia's Long-Term Stewardship program, looking for opportunities to optimize operations and reduce organizational risk.

Long-Term Stewardship (LTS)

- Responsible for performing inspections, monitoring, maintenance, and reporting on over 300 Sandia sites in New Mexico and California
  Landfills, spill sites, groundwater, etc.
- Reduces and manages risk to human and environmental health
- Has requirements from the federal, state, and Sandia level

Figure 1: Groundwater sampling at the Chemical Waste Landfill

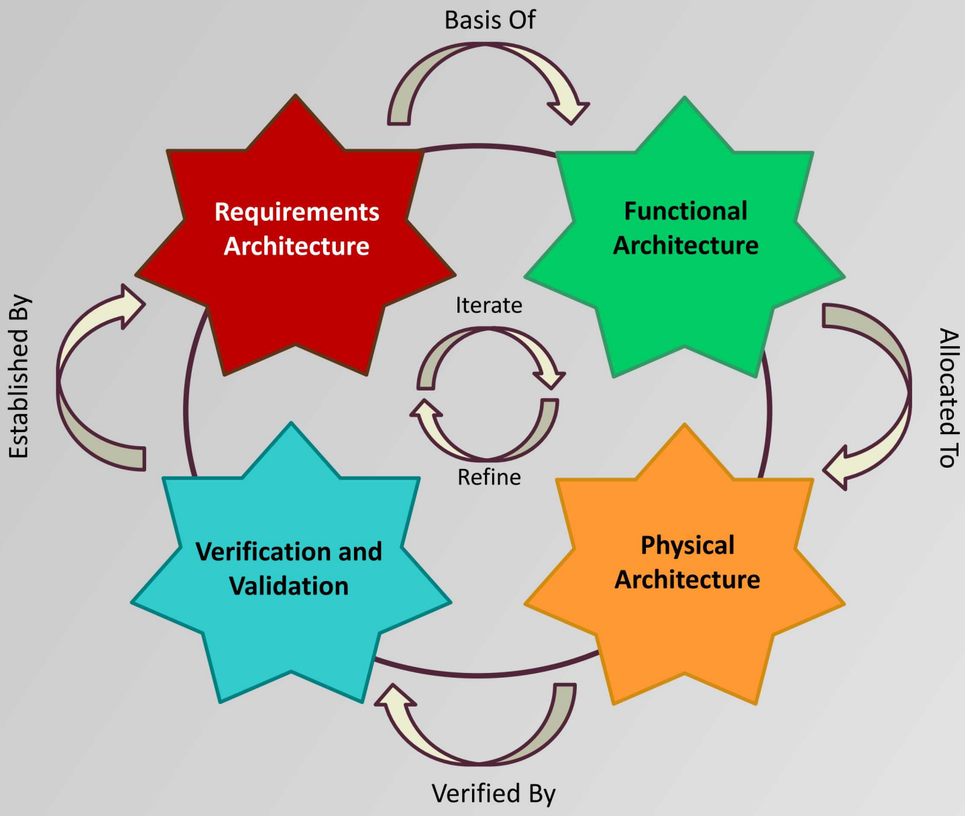

Figure 2: Four Domains of Systems Engineering

Model-Based Systems Engineering (MBSE)

- Method of modelling the aspects of a complex system in order to help support its design, development, and verification
- Generally applied to complex physical systems, such as a rocket or a car
- For this project:
  - Developed a high-level Requirements Architecture
  - Started a Functional Architecture
  - Laid foundation for Physical Architecture

Understanding the Data

- Applying an MBSE tool to a project management problem space
- Entity Relationship Diagram displays
  - How different object types will relate to each other
  - What each object means in the context of the program

Long-Term Stewardship	Genesys (MBSE Tool)
Project	Organizational Activity
Task Definition	Organizational Task
Requirement	Requirement
Form	Document
Training	Capability

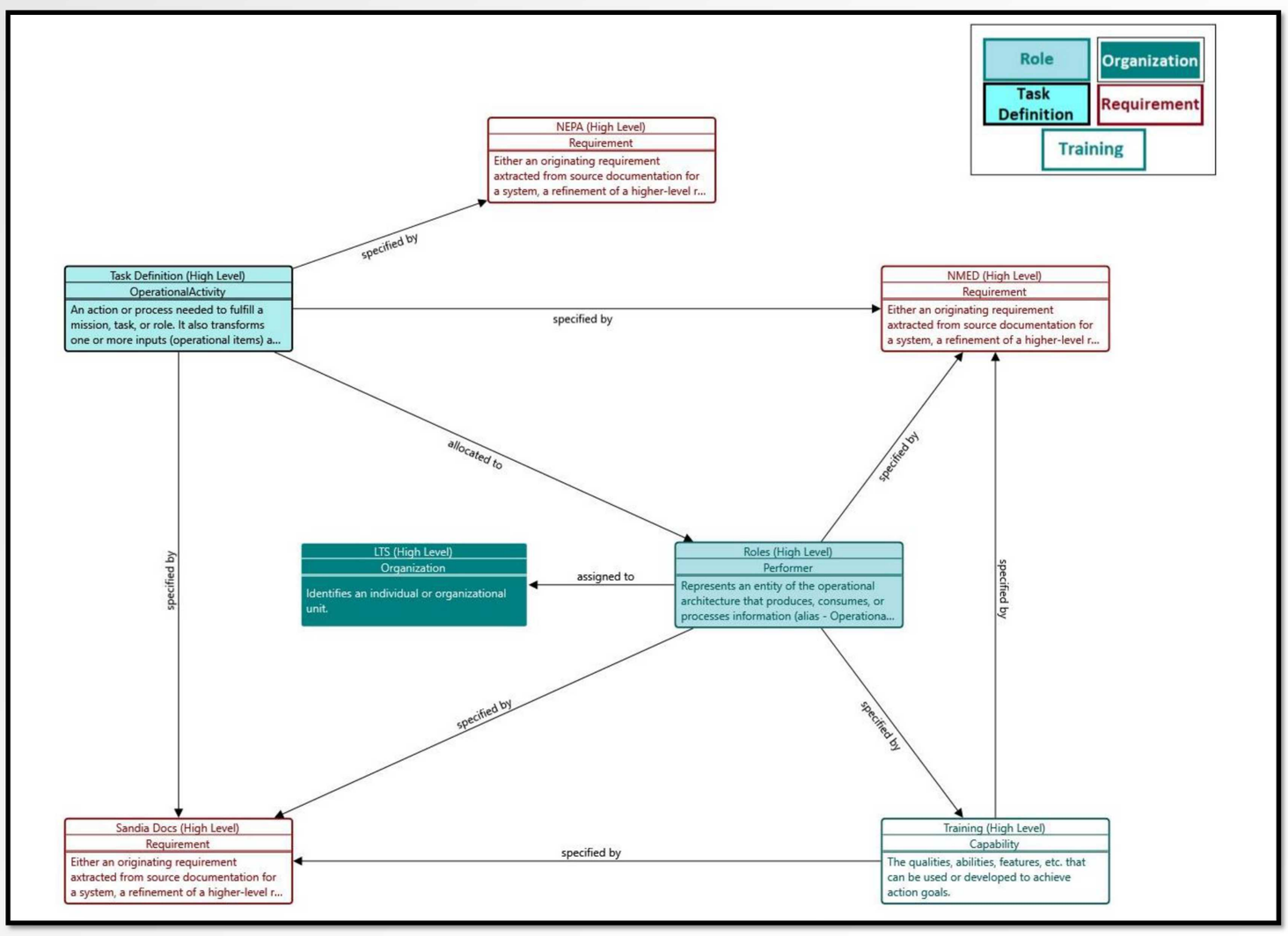

Figure 3: Entity Relationship Diagram

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Building Useful Diagrams for Analysis

- Diagrams evolved over time in order to best model the LTS program
- Diagrams should be readable and useful to LTS
  - Simpler diagrams can give ideas for simplifying operations to reduce risk
  - What makes a diagram "useful"?
- Simplify diagrams when possible

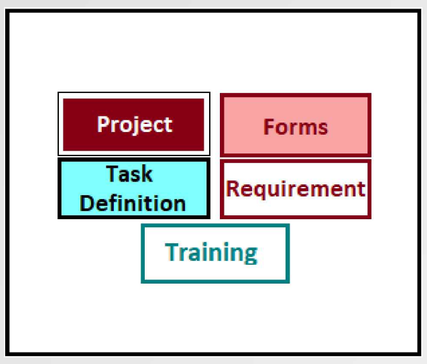

Figure 4: Diagram Legend

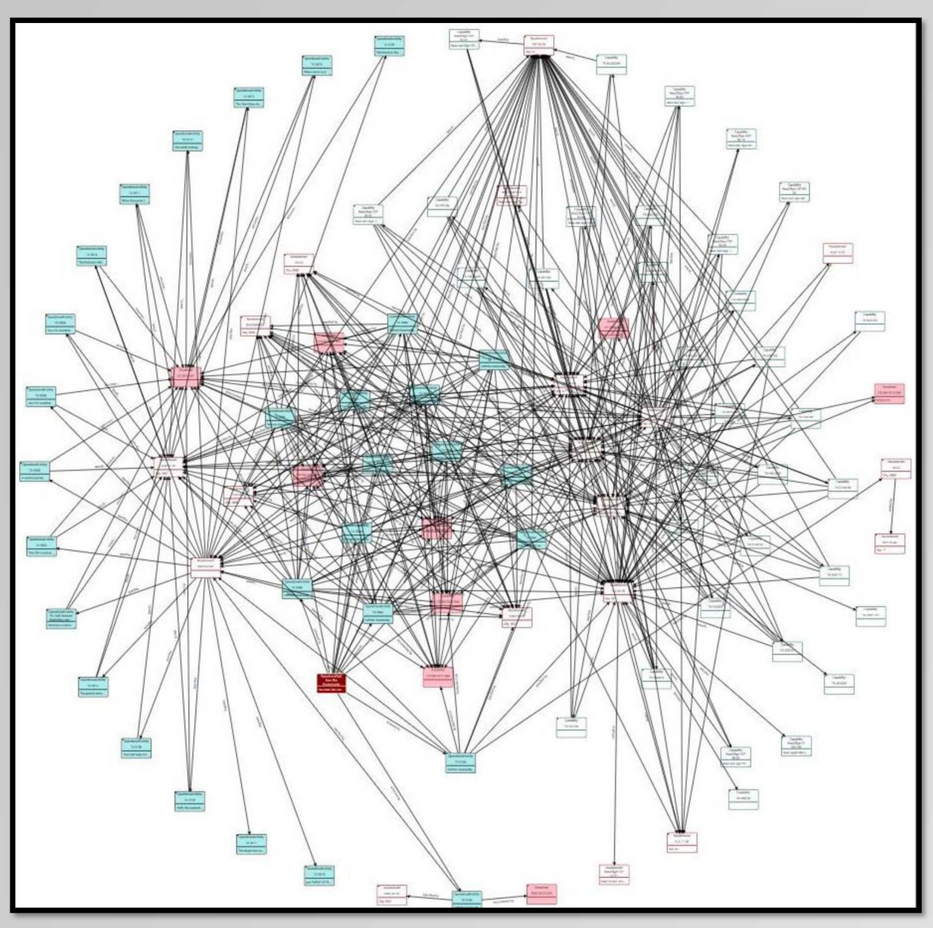

Figure 5: "Bird's Nest" of one of LTS's projects

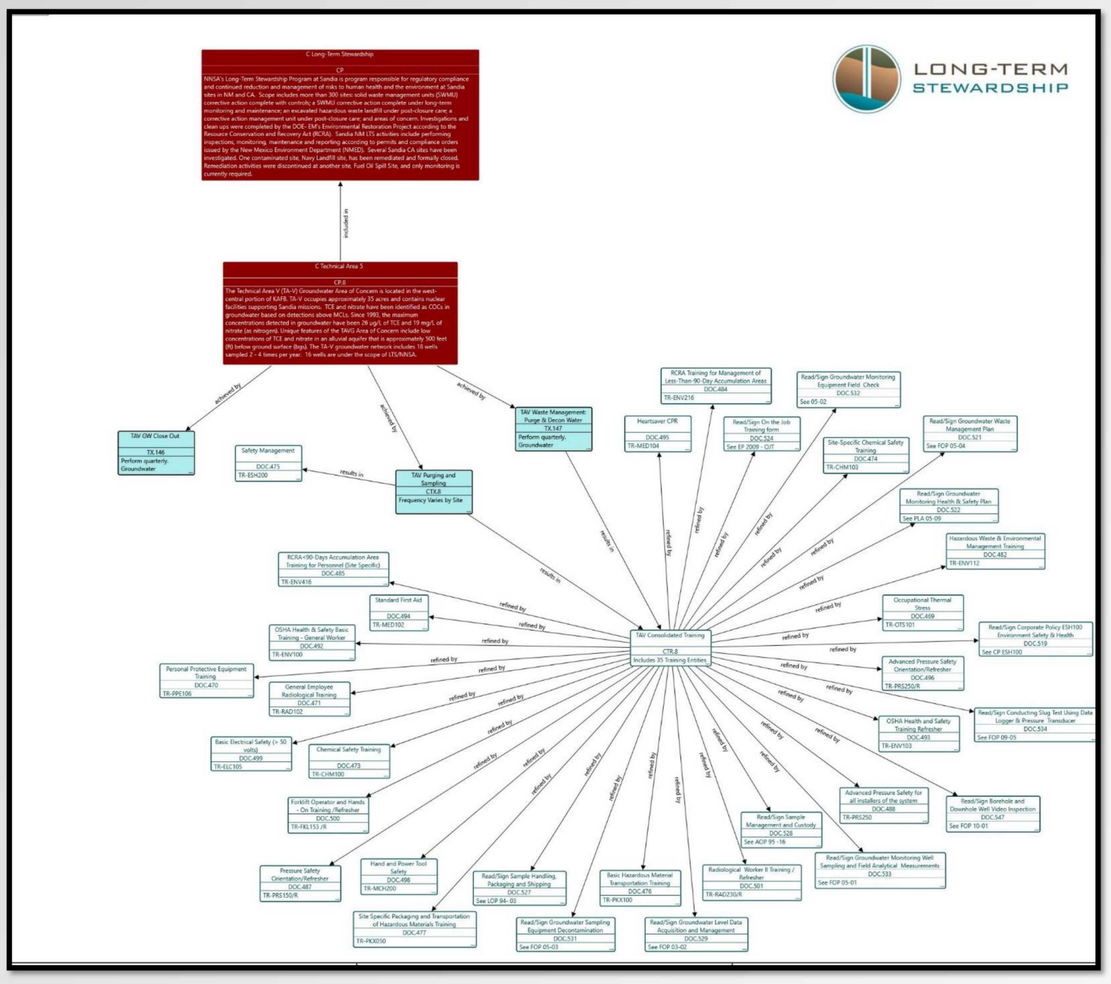

Figure 6: One LTS project's training, with similar tasks consolidated

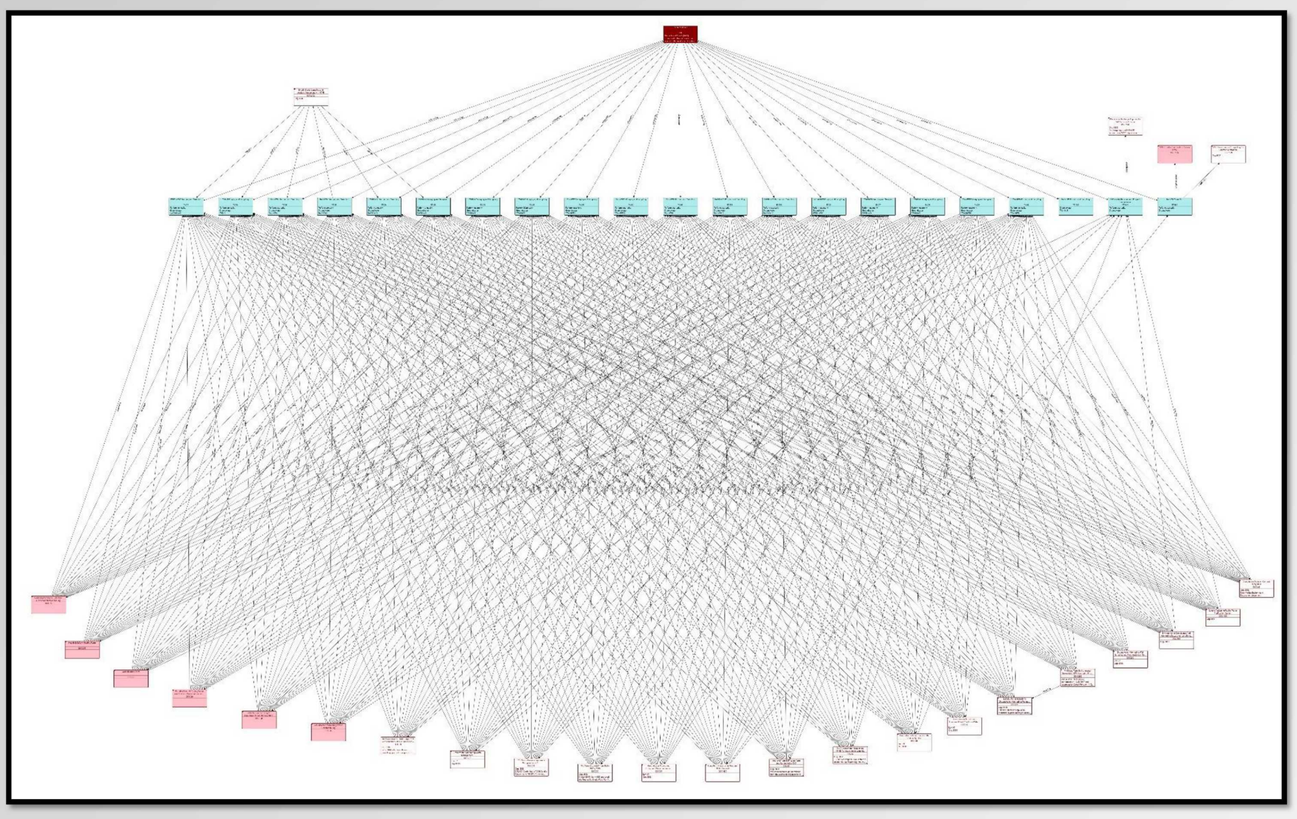

Figure 7: Representation of one of LTS's projects, the tasks that achieve it, and the requirements and documents associated with each task

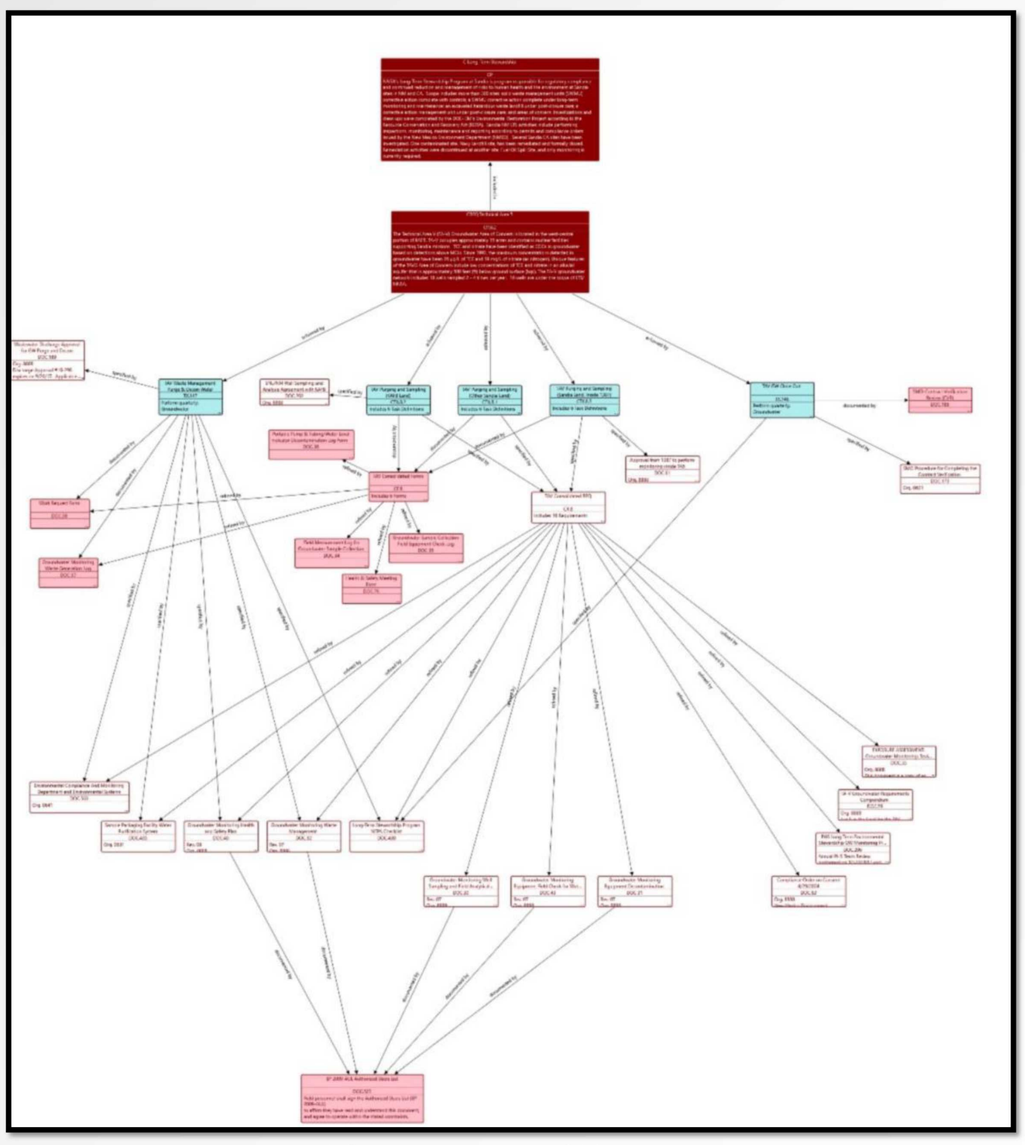

Figure 8: Simplified version of the diagram in Figure 7

Conclusions and Future Work

- Immediate benefits of the project
  - Validation and verification of LTS program
  - Identification of potential areas for simplification (particularly in training and requirements documents)
- In the next few weeks: Social Network analysis
- Future work: incorporating Roles, Equipment, and Organizations to tie in a Physical Architecture

References:
1. *Genesys*. s.l. : Vitech Corporation. GENESYS Version 6.0.
2. L. Salguero, J. Huff, A. Matta, S. Collins, *Using Enterprise Architecture for Analysis of a Complex Adaptive Organization's Risk Inducing Characteristics*, 35th International System Safety Conference, 2017.